Reconsideration of the requirement for numerals in the drawings in place of the legends is respectfully requested because mere empty boxes, particularly in flow diagrams, with just a reference number, are very difficult to interpret and require copious turning back to the specification; whereas legends (which have also long been permitted by the Rules of Practice in lieu of numbering) make it much easier and clearer to follow.

Claims 3 to 17, 19, 20, 22 to 30 and 34 to 36 have been rejected under 35 U.S.C. 103(a) as the "obvious" incorporation into the system of the patent to *Chen et al* ('347) of "the method of manipulating parity of quantization to add information as suggested by *Sandford, II et al*."

Claim 18 has been similarly rejected, further in view of *Qi et al* mentioning Bezier splines.

Claim 31 to 33 have been rejected as anticipated by *Chen et al* under 35 U.S.C. 102(e).

The Office appreciates, however, that the patent to *Chen et al* does not anticipate applicants' invention as expressed in any of claims 3 to 17, 19 20, 22 to 30 and 34 to 36--this patent totally lacking any disclosure whatsoever or even concept or suggestion of the startling results that applicants can attain in greatly expanding data embedding from the mere low bit "watermarking" insertions of the reference system, into the kinds of supplemental thousands of bits of information that can be embedded by applicants--including, indeed, "entire computer programs, multi-media annotations, or lengthy supplemental communications...interactive and traditional advertising, e-commerce solicitations, games, interactive music, videos, etc.", (page 7 of applicants' specification) --never before possible.

Applicants discovered this possibility of embedding such large amounts of supplemental data without deleterious degradation of the pre-recorded digital media file through incorporating a <u>new</u> type of "LSB parity encoding...(which)

allows more choice regarding the coefficients to be modified" (page 16) than prior LSB parity encoding (such as *Sandford II et al*), and also wherein "the parity of the coefficients can be computed by adding them together" (page 17).

Nowhere does *Chen et al* disclose applicants' discovery of embedding such large amounts of supplemental data and information, nor do the patentees deal with anything other than low-bit "watermarking", as the Office concedes. And nowhere does this reference indicate even a motivation for embedding applicants' type of information, let alone any useful purpose for parity coding of any kind, and certainly not applicants' new type of LSB parity encoding. In the words of the Office:

> "omitted by *Chen et al* is embedding the watermark of supplemental information with the parity on only the least significant bits in the low-bit modulation (LBM) technique of *Chen et al*,"

Chen et al simply did not make applicants' discovery.

With the "hindsight" of applicants' invention, however, the Office has proposed that *Sandford II et al* would have made it "obvious to one of ordinary skill in the art to apply the method of manipulating parity quantization to add information".

But *Sandford II et al* neither discloses applicants' novel type of claimed parity least-significant bit operation, nor even hints that the use of any other type of parity least-significant bit manipulation would open up systems like *Chen et al* to enabling large amounts of information to be encoded--many times that possible with *Chen et al's* low bit watermarking information.

The Court of Appeals for the Federal Circuit has recently chided the Patent Office for the legal impropriety of such use of "hindsight", where the principal reference has absolutely no motivation, let alone suggestion or teaching [in this case of even needing let alone using thousands of bits of encoded program data], noting

> "the insidious effect of a hindsight syndrome where that which only the invention taught is used against the teacher". [In re Dembiezak, 175 F. 3d 994, 50 USPQ 2d 1614, Fed. Cir. 1999];

and further pointing out that

> "...the suggestion to combine requirement, stands as a critical safeguard against hindsight analysis and rote application of the legal test for obviousness." [In re Roufett, 149 F. 3d 1350, 47 USPQ 2d 1453, Fed. Cir. 1998].

Altogether apart from the impropriety of this "obviousness" ground of rejection, moreover, as previously stated, applicants use a very different and novel type of LSB parity encoding than *Sandford II et al.* The *Sandford* type LSB encoding, indeed, even if incorporated somehow into the system of *Chen et al*, still would not achieve applicants' results or meet the limitations of applicants' claims, particularly as amended, that are restricted to applicants' novel type of LSB parity encoding, as will now be explained.

Applicants' Novel Results

It should first be recalled that the types of applications which the present invention enables, include the embedding of interactive programs inside media content. These programs can consist of advertisements, polls, games, utilities, or any executable program content. Since these types of applications are typically quite large (from a few hundred kilobytes to several megabytes), they simply cannot be embedded with existing, slower types of data embedding such as the *Sandford II et al* Least-Significant Bit Embedding, let alone do so with allowing the practically undetectable interference with the audiophile-quality recordings, and while introducing orders of magnitude less noise than any other technique.

The applicants' novel type of "Least-Significant Bit Parity Embedding", greatly extends the amount of information that can be placed into a media stream before the differences become audible. In particular, it changes the amount of noise introduced from the order of 1/X characteristic of prior techniques such as the *Sandford II et al* type of Least-Significant Bit Embedding, to an order of 1/(2X=2)^2 (where X represents how often data bits are embedded in the media

file). This can be rephrased to state, that, for example, with embedding wherein 1 out of 20 least-significant bits are changed, applicants' technique introduces only about 2.3% of the noise of the Least-Significant Bit technique described in the prior art, thus allowing applicants' technique to be used with audiophile recordings and archive-quality media. Continuing this example, applicants can increase the data rate to embed data in 1 out of 4 LSBs, five times as much data, before the introduced noise approaches that of these earlier, less advanced, techniques. This is a fundamental transformation of the characteristics from the prior art such as *Sanford,* and opens up many useful applications that just cannot be feasibly created with other existing technologies. Applicants' technique, indeed, can be used either to embed much larger amounts of data than previous techniques with the same amount of introduced noise, or it can be used to embed the same amount of data as previous techniques, but with drastically lower amounts of introduced noise.

As an example, CDs use 44,100 16-bit samples/second. Modifying 1 out of 40 of the samples and embedding data with the prior art Least-Significant Bit techniques, means that 882 bits/second can be embedded in the CD. In a simple approximation, since each modification results in an average of ½ bit of noise added to the data stream, this means that about 441 bits of noise have been added. Now, if applicants modify 1 out of 50 of the samples using their LSB Parity Embedding technique, they still will embed 882 bits/second. Because they choose which of the 50 samples to embed in, however, assuming that the sample errors are uniformly distributed, they only add 1/102 bit of noise per modification, using the previous formulae. This means that only 8.6 bits of noise have been added in order to embed 882 bits of data, an over 50-fold reduction in noise. Conversely, what is the data rate using LSB Parity embedding that would correspond to introducing 441 bits of noise? That works out to modify about 1 out of 7 of the sample, or 6300 bits/second of data embedded, a more than seven-fold

improvement over *Sanford's* LSB embedding and essential to allow applicants' new results of such large amounts of supplemental information embedding without noticeable impact on the pre-recorded information reproduction.

The Type Of LSB Encoding Of Sandford II et al
Is Not That Used By Applicants Or That Specified In Applicants' Claims

As described in our previous response to the Patent Office action, *Sandford II et al* does not teach applicants' technique, found essential to produce applicants' novel results. In column 3, lines 26 to 43, they use the term "quantizer parity" to describe, however, a completely different technical approach (the source code archive of Upham, and the paper published by Matsui et al). It is unfortunate that they chose a similar term to describe something so different, but such is often the case with novel technologies.

Sandford II et al, indeed, uses the term "quantizer parity" to describe only "Least-Significant Bit Embedding". There is nothing in this patent or in any of the prior art cited by *Sandford* that teaches or anticipates, however, applicants' technique of spreading the data embedding across multiple bits, thus gaining applicants' ability to place large amounts of data in a media stream without adverse impact to the quality. It is like the difference between spread-spectrum and frequency-modulation in radio. The prior art presented in *Sanford* and Upham, as C source code, is simply the placement of a single bit of information on the least-significant bit of a JPEG photo. The prior art taught in Matsui and Tanaka is the same, applied to various types of images. The problem with the technique taught in these two documents and *Sandford* is that they introduce substantial amounts of noise into the media file, making the attaining of applicants' results impossible.

A thorough review of both the *Sandford et al* patent, and the prior art cited in column 3, lines 26 to 43, namely the JSTEG source code available at ftp://ftp.csua.berkerley.edu/pub/cypherpunks/steganography/jsteg (Upham), as well as the Matsui and Tanaka article ("Video-Steganography: How to Secretly

Embed a Signature in a Picture", International Multimedia Assoc. Intell. Prop. Project Proc., 1994), reveals only a description of common prior art "Least Significant Bit Embedding". They do not teach, discuss, or anticipate any techniques of extending the embedding of information to multiple coefficients which is the novel approach of applicants and which is described in their patent application as "Least-Significant Bit Parity Embedding".

As will later be pointed out, applicants' novel embedding in multiple coefficients is clearly recited in the claims, particularly as amended, distinguishing from any incorporation of any teaching of *Sandford II et al* in the system to *Chen et al.*

All of Applicants' Claims, As Amended,
Clearly Define Applicants' Invention Over
Any Possible Combination Of The References,
Even If Such Proposed Combination Were Proper

Apparently recognizing that applicants have made a significant advance over the mere low data bit watermark encoding of *Chen et al*, the Office has none the less construed the original claims as broad enough to embrace such low data bit watermark encoding, pointing out in connection with original claims 31 to 33, that

> "The claims do not specify any particular type of information to be embedded or the relative size thereof. Nor does the language of the claims recite any specific limitation with respect to the number of bits per second."

As amended, accordingly, the claims now clearly distinguish the types of information embeddable by applicants' technique, the relative size thereof, and specific limitations s to the break-through in number of embedded bits per second now for the first time achievable--thus clearly defining over the cited art, individually and collectively.

Claims 31-33 now identify the embedded supplemental digital data as "selected from the group consisting of interactive and traditional advertising, merchandising materials, e-commerce, solicitations and messages, polls, video

games, interactive music and audio/video programs, and computer programs" (page 7 of specification)--clearly definitive over low bit watermarking data.

The claims further specify the embedding of at least "thousands of bits of said supplemental digital data"--a breakthrough of the invention--and at "selected multiple coefficients" of the sets of coefficients, again as contrasted with the prior art placement of a single bit of information in the least significant bit. Such is not at all applicants' spreading of the data embedding across multiple bits that enables the new result of placing of large amounts of data in a media stream without adverse impact upon the quality. Claims 31-33 also further define over the cited reference in specifying that the thousands of bits of supplemental digital data are embedded at "data rates from hundreds to thousands of 'kilobytes and higher'" (bottom of page 14 and page 15 of specification).

Parent process and apparatus claims 7 and 34, and 27, respectively, have been similarly amended not only to specify the novel type of embedded information, but also the distinguishing of at least "thousands of bits of said supplemental digital data", and in further contrast to the cited prior art, at "data rates from hundreds to thousands of kilobytes and higher".

In still further distinguishment from the cited prior art, moreover, these amended claims specify applicants' novel type of least significant bit parity encoding (as contrasted from *Sanford 11 et al*) wherein the embedding occurs at "selected multiple coefficients of each set" and with "single bits of data... embedded in each of a number of coefficients of each set and by computing the parity of such least-significant bits of a group of said coefficients" (claim 7, for example).

Since the remaining claims 3-6, 8-20, 22-26, 28-30, 35 and 36, all depend from these amended parent claims, they are also allowable in their distinguishment from the cited references.

With further regard to claim 18, the patent to *Qi et al* in merely mentioning Bezier splines, hardly supplies the deficiencies in *Chien* and *Sanford* required to anticipate applicants' complete claimed process of the claim.

Additional claims 37-42 all depend from allowable claim 32 adding further specific details foreign to any possible combination of the references: the use of 4 to 16 coefficients (claim 37); groups of eight or more coefficients (claim 38); bit encoding until complete (claim 39); eight coefficients and succeeding bytes encoding the coefficients of the first byte (claim 40); the choice for every seventh coefficient (claim 41); and the wide frequency range of each group of coefficients (claim 42).

Applicants concur with the Office that the further patents to *Chen et al* ('192), Zhang et al, Levine, Adler et al and Maskovitz merely disclose related art, but not anticipatory of applicants' invention.

Reconsideration and allowance are thus respectfully requested.

Any costs required in parent application S.N. 09/389,941 and by this continuing application filing and amendment, as otherwise, and the costs for required time extensions, petition for which is hereby made, may be charged to Deposit Account No. 18-1425 of the undersigned attorneys.

Very respectfully,

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